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TECHNICAL MANUSCRIPT 376

INHIBITION OF FLOWERING IN XANTHIUM PENSYLVANICUM WALLN. BY ETHYLENE

Frederick B. Abeles

APRIL 1967

DEPARTMENT OF THE ARMY
Fort Detrick
Frederick, Maryland

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INHIBITION OF FLOWERING IN *XANTHIUM PENSYLVANICUM* WALLR. BY ETHYLENE

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Crops Division
BIOLOGICAL SCIENCES LABORATORY

Project 1L013001A91A April 1967

INHIBITION OF FLOWERING IN XANTHIUM PENSYLVANICUM WALLN. BY ETHYLENE

ABSTRACT

Ethylene inhibited the formation of flowers in cocklebur (*Xanthium pensylvanicum* Walln.) plants that were exposed to an inductive dark period. Indoleacetic acid had been shown earlier to have this same effect. Because it stimulates ethylene evolution from cocklebur leaves, the results suggest that the effect of auxin may be an ethylene effect.

Bonner and Thurlow[1] reported that indoleacetic acid (IAA) inhibited the formation of flowers in cockleburs (*Xanthium pensylvanicum* Walln.) when it was applied as a spray during the long inductive night. In the present report, evidence is presented that ethylene also inhibits the flowering of cocklebur plants that have been exposed to a long inductive photoperiod and that the IAA effect is probably due to auxin-stimulated ethylene production.

The two large apical beaks were cut from cocklebur fruits (Chicago strain*) and the fruits were washed in running water for 24 hours and planted in 4-inch pots of soil; seedlings were grown for 3 weeks at 25 C on a 16-hour light cycle (1,500 ft-c) supplied by daylight fluorescent bulbs. The plants were induced to flower by exposure to 16 hours of darkness in 10-liter desiccators containing 0, 1, 10, or 100 ppm ethylene. After the induction period, the plants were returned to the growth chamber; the sizes of the inflorescences were measured 8 weeks later. Ethylene evolution from the plants was measured by gas chromatography.[2]

The inflorescences of the two controls receiving no ethylene were 5 and 8 mm in diameter and in anthesis. After 16 hours in the desiccator, the level of ethylene in the gas phase had risen to 0.025 ppm. One of the plants treated with 1 ppm ethylene remained vegetative and the other had an inflorescence 2 mm in diameter. The two plants treated with 10 and 100 ppm ethylene remained vegetative. Except for an initial temporary leaf epinasty, the ethylene treatment had no effect on the subsequent growth and vigor of the plants when compared with controls maintained on long days. This experiment was repeated on three other occasions and

* Supplied by F.B. Salisbury, Utah State University, Logan, Utah.

similar results were obtained. Ethylene production from untreated cocklebur plants during the 16-hour dark period was 7 nl per hour per plant. Spraying prior to the dark period with 10^{-4} and 10^{-3} M IAA until runoff increased the rate of gas production to 14 and 28 nl per hour, respectively.

Some recent examples of auxin effects shown to be ethylene effects include the stimulation of abscission by auxin,[2] the auxin-induced inhibition of growth of pea stem sections,[3] and the induction of flowering of pineapples.[4] Palmer[5] recently reported that high levels of IAA would inhibit the induction of invertase in aged beetroot (Beta vulgaris L.) tissue slices. Using the same species Scott[6] reported that 10 ppm ethylene would also inhibit invertase synthesis. Another example of auxin-ethylene effects may be the development of sex in monoecious species. In a recent review, Nitsch[7] pointed out that treatments by auxin and unsaturated gases such as ethylene, CO, and acetylene favor the formation of female flowers on cucumber (Cucumis sativus L.) plants. The results presented here suggest that the inhibition of flowering in the cocklebur by auxin may also be an ethylene effect.

The mechanism by which ethylene prevents the induction of floral primordia is unknown. However, it is known that RNA synthesis[8,9] and presumably protein synthesis[8,10] are an essential part of the induction process. It is known that ethylene can enhance RNA and protein syntheses in ethylene-sensitive tissue,[11] suggesting that ethylene may interfere in some way with the orderly production of RNA required for the flowering process.

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